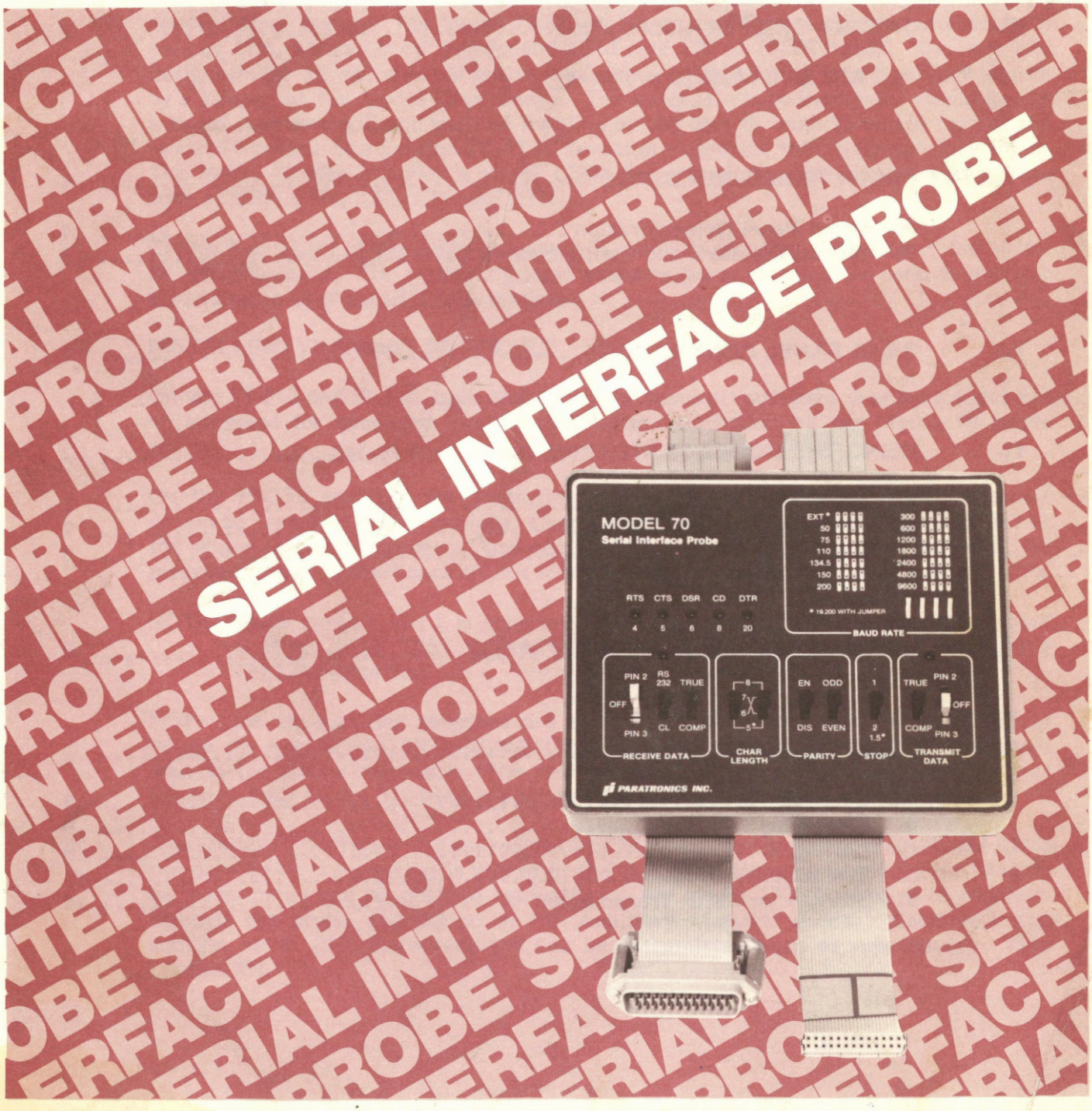
NICOLET
PARATRONICS
CORPORATION

Model 70
Serial Interface Probe

User's Instructions



** TABLE OF CONTENTS **

SECTION		PAGE
I.	GENERAL DESCRIPTION	1
II.	INSTALLING THE TRANSMIT SOFTWARE	1
III.	THEORY OF OPERATION	2
	A. RECEIVE Mode Data Format	
IV.	FRONT PANEL DESCRIPTION	4
	A. Front Panel Demonstration	4
	B. Menus, Displays, and Configurations	5
V.	REAR PANEL CONNECTIONS	6
VI.	USING THE MODEL 70 WITH THE PI-648 AND PI-540	7
	A. Receiving Data	7
	B. Transmitting Data	7
	C. Triggering	8
VII.	USING THE MODEL 70 WITH THE PI-532	8
VIII.	USING TEST DATA ON THE 532	9
	A. Entering	9
	B. Examining	9
	C. Editing	9
	D. Transmitting	10
	E. Storage for Later Transmission	10

MODEL 70 SERIAL INTERFACE PROBE

I. GENERAL DESCRIPTION

The Model 70 Interface Probe is used with the PI-540, 648, or 532 Logic Analyzers to provide the interface required to record and analyze asynchronous RS-232, CCITT V.24, and 20 mA current loop operations. The Nicolet Paratronics Model 70 Serial Interface Probe may also be used to transmit RS-232 data. The M70 transmit software must be installed to enable this function (see Section II, Installing transmit software.) This function is accessed by the logic analyzer's configuration menus. The Model 70 offers front panel selection of parameters such as stop bits, parity, word length, and baud rate (50 to 19.2K baud). The user can designate the all-switches up position as either 19.2K baud or external clock source by a jumper on the Model 70 pc board. The external clock frequency should be (16 x (baud rate desired)) and shall be supplied by the user through J1 on the rear of the Model 70 probe. See Section IV. TTL levels are used for this external clock input. The Model 70 also includes a set of LED's for real-time monitoring of status lines such as CTS, DSR, RTS, CD, and DTR.

Connection to all of the logic analyzers is made by plugging the cable of the Model 70 into channel A. The remaining logic analyzer ports can then be used to monitor additional related parallel information.

II. INSTALLING TRANSMIT SOFTWARE

On the PI-540 and PI-648 logic analyzers, the transmit software is standard and can be accessed for operation immediately upon connection of the Model 70 probe option.

On the PI-532 analyzer the transmit mode requires that the Model 70 software option be installed on the optional User's Program Board at socket location #1, at the upper left-hand corner. Also required is that a 74LS244 Octal Buffer IC be installed in the motherboard socket location U59, in the far left-hand row of I.C.'s.

NOTE: Make certain Pin 1 is oriented correctly on both I.C.'s. It should be noted that the SELF TEST SIGNATURE will be different upon power on with the 74LS244 installed.

Make sure all qualifier switches are set to "X" (don't care) and press RESET to obtain the new STANDARD SIGNATURE. Record this signature in the Operator's Manual for future reference. The new power-on self-test signature indicates that the particular Model 532 used is equipped for bidirectional data transmission.

The Model 70 Software Option resides in PROM in the User's Program Board while the data to be transmitted is stored in the Auxiliary Memory Board. Test data to be transmitted can be entered manually via the Model 532's keyboard, or received through the probe and stored in the Auxiliary Memory Board. Each test can contain up to 250 characters and can be transmitted once or repetitively. (See Section VII.)

III. THEORY OF OPERATION

The Model 70 Serial Interface Probe is designed around a single LSI UART device. The UART (Universal Asynchronous Receiver/Transmitter) performs serial-to-parallel conversion between the incoming serial data to be recorded and the logic analyzer.

Both transmit and receive modes operate in full-duplex.

The UART is programmed by switches on the probe. The baud rate of data to be processed is selected by the row of switches on the front panel, which programs the internal crystal controlled baud rate generator of the Model 70. The UART provides a clock pulse to the analyzer when the character, RTS, CTS, DSR, CD, DTR and the three error lines are valid. The three error lines monitored are Parity, Framing, and Overrun. The LED's are driven directly from receivers on the RS-232 interface and they flash as the lines toggle to give a visual indication of activity. In all cases, an illuminated LED indicates a high level (RS-232 "SPACE").

A. Receive Mode Data Format

Data captured and displayed by the Model 70 has the following significance.

A Channel Data Input	Signal Description
D15 DTR	Data Terminal Ready
D14 CD	Carrier Detect
D13 DSR	Data Set Ready
D12 CTS	Clear to Send
D11 RTS	Ready to Send
D10 PE	Parity Error
D9 FE	Framing Error - First Stop bit invalid
D8 OE	Overrun Error - Model 70 missed a character
D7 MSB	Data Bit 7
D6	Data Bit 6
D5	Data Bit 5
D4	Data Bit 4
D3	Data Bit 3
D2	Data Bit 2
D1	Data Bit 1
D0 LSB	Data Bit 0

Formats

The Model 70 probe allows a number of character and data line formats to be used. The switch settings for these formats are described below.

Data Source

The received data may come from one of three data sources: current loop, RS-232 pin 2, or RS-232 pin 3. For RS-232 pin 2 or pin 3, set the RCV data switch to the appropriate position. This switch may be set to OFF to avoid collecting data at a particular time. The RS-232/CL switch is set to RS-232 position. For current loop inputs, the input switch is set to OFF and the RS-232/CL switch to CL. The current loop interface is obtained through J1 on the rear of the Model 70. (For information see the Rear Panel Connection Section V).

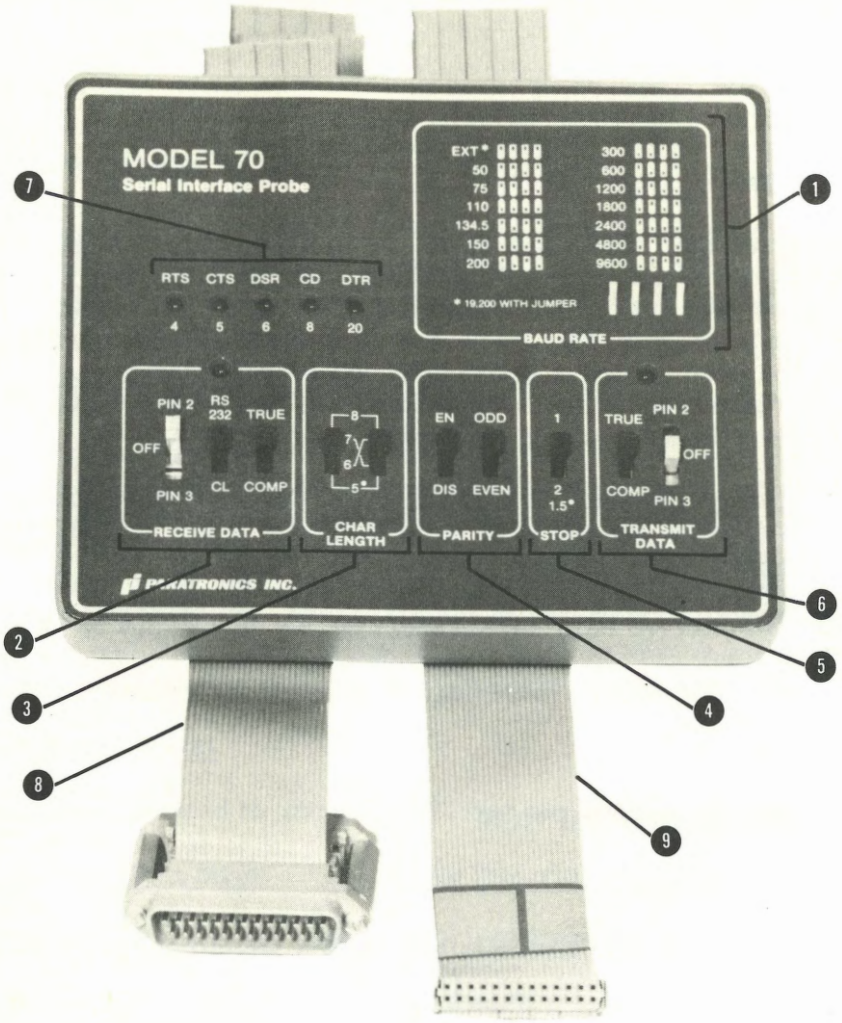
If the sense of the input line is inverted, the RCV Data True/Comp switch should be set to Comp. Normally, it will be set to True. RS-232C conventions dictate mark = logic 0 = -3.0 volts.

NOTE: The receive data switch must be set to the pin to be monitored: pin 2 or pin 3 or off. Transmit data pin select switch similarly determines on which pin data will be transmitted when under control of the optional transmit software.

IV. FRONT PANEL DESCRIPTION

A. Front Panel Illustration

The following section discusses the switch selections available on the Model 70 Probe.



(1) **Baud Rate:** Select by setting the four small switches to correspond to the rate of the data being analyzed.

(2) **Receive Data:** Select pin 2 or 3 to monitor data. When switch is in the OFF position, the probe cannot receive data. The LED indicates data activity exists on the pin selected.

(3) **Character Length:** Select 5, 6, 7, or 8 bit word by setting the switches as indicated.

(4) **Parity:** Select ODD or EVEN, provided EN (Enable) is selected. If DIS (Disable is selected, the probe ignores parity.

(5) **Stop bits:** Select 1 or 2 stop bits. If the character length is 5 bits, the switch will select 1 or 1.5 stop bits.

(6) **Transmit Data:** Used when the transmit mode of the logic analyzer is selected. Determines on which line of the RS-232 interface the data transmission will be. RS-232 data is normally transmitted in true format except for current loop mode operation. Current loop RS-232 data is transmitted complemented (COMP). The LED flashes to indicate data activity exists on the selected pin.

(7) **Leds** for RTS, CTS, DSR, CD, and DTR indicate state of these lines.

(8) **Interface** cable for RS-232 data line with standard 25 pin EIA connector tee.

(9) **Input** cable between logic analyzer and Model 70 probe.

B. Menus, Displays, and Configurations

The following section will discuss the menus, displays and configurations available to the user when using the Model 70 with the PI-540 and PI-648 Logic Analyzers.

Figure 1.

Figure 1 shows the configuration menu of the PI-648 upon power-up. Pressing STEP FWD will select the M70 XMIT mode of operation.

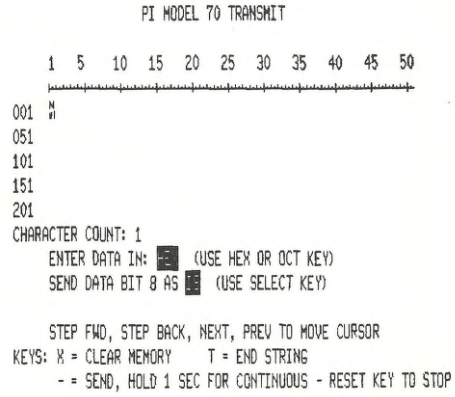

PI MODEL 70 TRANSMIT
1 5 10 15 20 25 30 35 40 45 50
001
051
101
151
201
CHARACTER COUNT: 1
ENTER DATA IN:
(USE HEX OR OCT KEY)
SEND DATA BIT 8 AS
(USE SELECT KEY)
STEP FWD, STEP BACK, NEXT, PREV TO MOVE CURSOR
KEYS: X = CLEAR MEMORY T = END STRING
- = SEND, HOLD 1 SEC FOR CONTINUOUS - RESET KEY TO STOP

Figure 2.

Figure 2 shows the menu displayed when the Model 70 Transmit has been called up for use. As shown in Figure 4, the user is prompted by the menu as to send, end string, and clear memory.

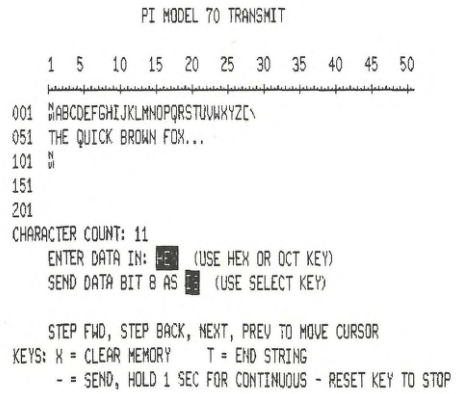

PI MODEL 70 TRANSMIT
1 5 10 15 20 25 30 35 40 45 50
001 ABCDEFGHIJKLMNOPQRSTUVWXYZ[\
051 THE QUICK BROWN FOX...
101
151
201
CHARACTER COUNT: 11
ENTER DATA IN:
(USE HEX OR OCT KEY)
SEND DATA BIT 8 AS
(USE SELECT KEY)
STEP FWD, STEP BACK, NEXT, PREV TO MOVE CURSOR
KEYS: X = CLEAR MEMORY T = END STRING
- = SEND, HOLD 1 SEC FOR CONTINUOUS - RESET KEY TO STOP

Figure 3.

Figure 3 shows an example with ASCII characters entered into the analyzer. An ASCII conversion chart is provided in the manual. Be advised that the data shown in Figure 5 was chosen at random, your data can be different.

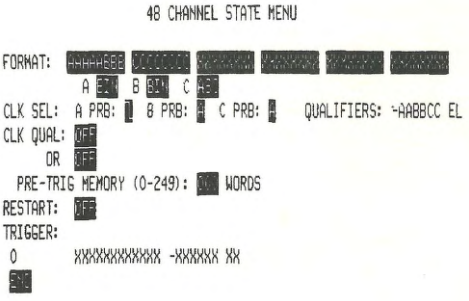


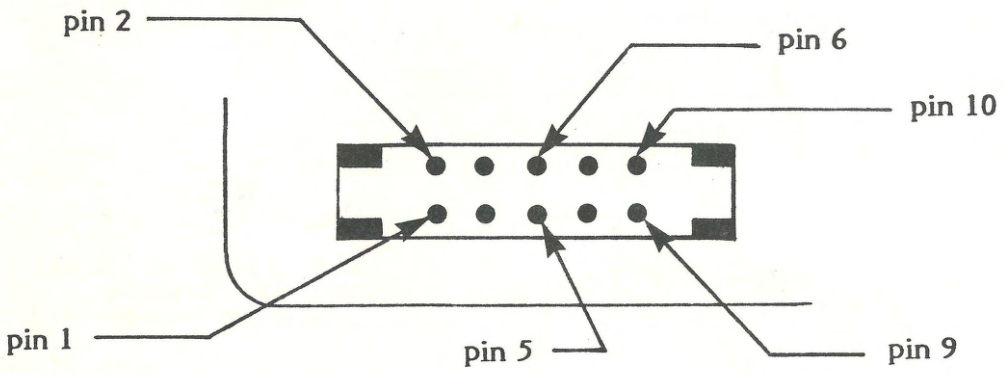
Figure 4.

Figure 4 is the menu setup required for data collection on the PI-648. Note that the negative clock edge is selected. Set up for the PI-540 is similar.

V. REAR PANEL CONNECTIONS

An external clock source can be employed by the user when all of the switches are in the down position and a standard TTL input is applied to pin 6 of J1 at 16 times the desired baud rate.

The current loop interface is obtained through J1 as shown below in Figure 5.



pin 2: + 20 mA XMIT DATA

pin 1: - 20 mA XMIT DATA

pin 6: External clock input at 16x baud rate, TTL level

pin 5: Ground

pin 10: + 20 mA RCV DATA

pin 9: - 20 mA RCV DATA

Figure 5. J1 connections for 20 mA current loop and external clock input at rear of Model 70 probe.

VI. USING THE MODEL 70 WITH THE PI-648 AND PI-540

A. Receiving Data - PI-540, PI-648

Step 1 Select 32 channel state in the 540 or 48 channel state in the 648.

Step 2 Plug the M70 into the A channel.

Step 3 Plug the Tee connector into the RS-232 line.

Step 4 Select the baud rate to match the SUT (System Under Test).

Step 5 Select RS-232 or CL mode.

Step 6 Select pin 2 or 3 receive data.

Step 7 Select character length.

Step 8 Select parity as appropriate.

Step 9 Select number of stop bits.

Step 10 Make sure transmit data is off.

Step 11 Set up menu as shown in Figure 6.

Step 12 Press reset key. The logic analyzer will begin to collect data and display.

Step 13 Press save key to transfer data to AUX memory.

Step 14 Call configuration menu. Select M70 XMIT MENU.

Step 15 Press state menu key. Data will appear on screen in text format.

B. Transmitting Data with the PI-648 or PI-540

General

Data to be transmitted must be resident in the auxiliary memory of the analyzer. This data may be captured in a receive mode and saved in AUX, or be typed on a terminal and received by the M70 probe and saved in AUX, or be written from the analyzer keyboard as the Hex or Octal equivalent of the ASCII character. Saving the data can be accomplished by depressing the Save key. Once the data is captured, it may be viewed in a text format by going to the M70 XMIT mode.

Step 1 Data from Step 14 above may be transmitted by pressing the "S" key on the PI-540 or the minus key on the PI-648. The data may be changed by positioning the cursor at the location to be changed and entering the Hex or Octal equivalent of the ASCII character desired. The character will appear on the screen as it is entered.

C. Triggering (PI-540 or PI-648)

The trigger words must be entered as the hex equivalent of the character when triggering on data. In order to trigger on a data word, sequential triggering must be used. Remember that each character is a new word to the logic analyzer. For example, the trigger word is to be "0100". Each "word" (or character) must have the specific relationship to the previous "word" or character in order to capture the exact sequence. Also, in order to see the entire sequence, some pretrigger must be used.

VII. USING THE MODEL 70 WITH THE PI-532

Step 1 Plug the M70 into the A channel.

Step 2 Plug the Tee connector into the RS-232 line.

Step 3 Select the baud rate to match the SUT (System Under Test).

Step 4 Select RS-232 or CL mode.

Step 5 Select pin 2 or 3 receive data.

Step 6 Select character length.

Step 7 Select parity as appropriate.

Step 8 Select number of stop bits.

Step 9 Make sure transmit data is off.

Step 10 Set the A CLK switch on the 532 for falling edge and the B CLK to A CLK.

Step 11 Set the desired trigger word in the A TRIG register. For example, to trigger on the character "A" and don't care about the state of RTS, CTS, etc. the 532 should be set as follows:

ACLK	= ↓
QCLK	= X
QTRIG	= X
BCLK	= ACLK
QCLK	= X
QTRIG	= X
A (Trigger Word)	= XX41
B (Trigger Word)	= XXXX

Step 12 With the Model 70 probe plugged into the channel A port of the 532, reset the 532 and start the serial line. If you are typing the character string A, B, C, D, etc. or any string where the trigger word may be the very first character the analyzer will see, the first clock pulse must be found by moving the A clock switch up and then down before the serial data starts. Otherwise, the display of data captured will be missing the first character if it is the trigger word.

VIII. USING TEST DATA ON THE 532

A. Entering User Test Patterns on the 532

The following procedure allows a specific test pattern to be manually loaded into the RAM on the Auxiliary Memory Board:

Step 1 Clear the character counter by pressing CTL, SET A and *.

Step 2 Enter 0000 into the A display.

Step 3 Press CTL and SET B to select the B display and enter a character consisting of any two hex digits. (Hex digits in two most significant positions are ignored.)

Step 4 Press the DEP key to store the two least significant hex digits.

Step 5 Enter the next character into the B display and press DEP+. The A window will increment.

Step 6 Repeat Step 5 until the entire message (up to 250 characters) is stored.

B. Examining User Test Patterns on the 532

The following procedure allows a test pattern to be examined:

Step 1 In order to examine RAM contents, enter the character number in decimal into the A display and press the READ key. The corresponding hex value will then appear in the B display.

Step 2 In order to display successive characters, press CTL and then keep pressing the READ key.

C. Editing User Test Patterns on the 532

Step 1 Examine the location in RAM to be changed.

Step 2 Enter the new character into the B display.

Step 3 Press the DEP key.

Step 4 In order to change successive locations, enter the data into the B display, press DEP+, and repeat.

16338
W1702-6

D. Transmitting Test Data on the 532

Once a test is stored in RAM or one of the seven UV PROM's, the following procedure allows the data to be transmitted through the Model 70 probe:

Step 1 On the Model 70 probe, select either Pin 2 or Pin 3 of the RS-232 connector for transmission.

Step 2 Select the 250 character test to be transmitted by rotating the AUX SELECT switch on the Model 532 to the desired position.

Step 3 In order to transmit a test one time, press CTL and *.

Step 4 In order to transmit a test repetitively, press CTL and □ .

Step 5 In order to stop a repetitive transmission, activate the Model 532's RESET switch.

E. Storing Test Data for Later Transmission on the 532

The Auxiliary Memory Board permits eight tests to be stored: one in RAM and seven in UVE PROM's. (The Auxiliary Memory Board contains the appropriate PROM programmer.)

Keyboard-entered tests are always stored in RAM. Reference test patterns from a RS-232 or 20 mA communications channel can be stored as a 250-word block in RAM or UV PROM by collecting the desired information in the Model 532's main memory (via the Model 70 probe) and pressing the 532 SAVE key.

* * * * * * * *

For more information call:

800/538-9713 (Toll Free outside California)

415/490-8300**(California)**

Printed in U.S.A. 150-0070-001B